IFR status report

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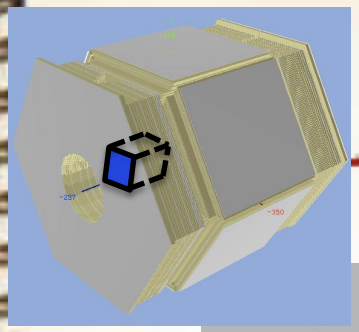
on behalf of the IFR group

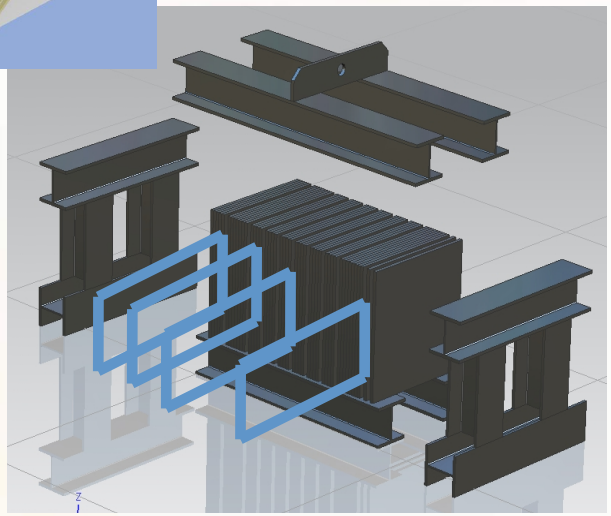
XV SuperB meeting – Caltech Dec 2010

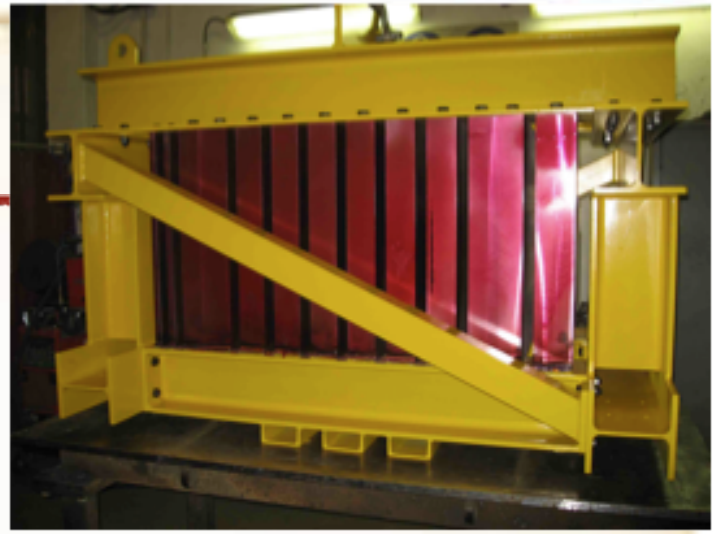
Outline

- Prototype preparation
- Beam test at Fermilab
- Plans for the TDR

IFR prototype

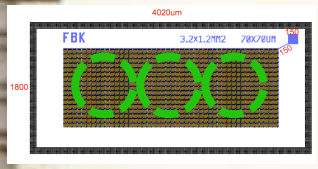


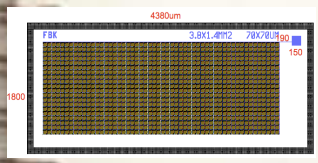


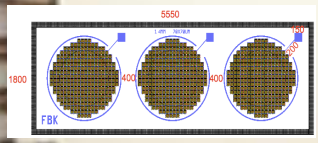


- Iron: 60×60×92 cm^3 , 3cm gaps for the active layers

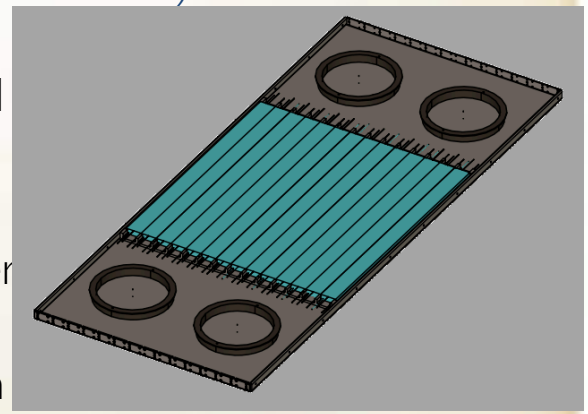
- Readout 9 active layers
  - 4 Layers Time readout (TDC-RO): 112 channels
  - 5 Layers Binary Readout (BiRo) 125 channels







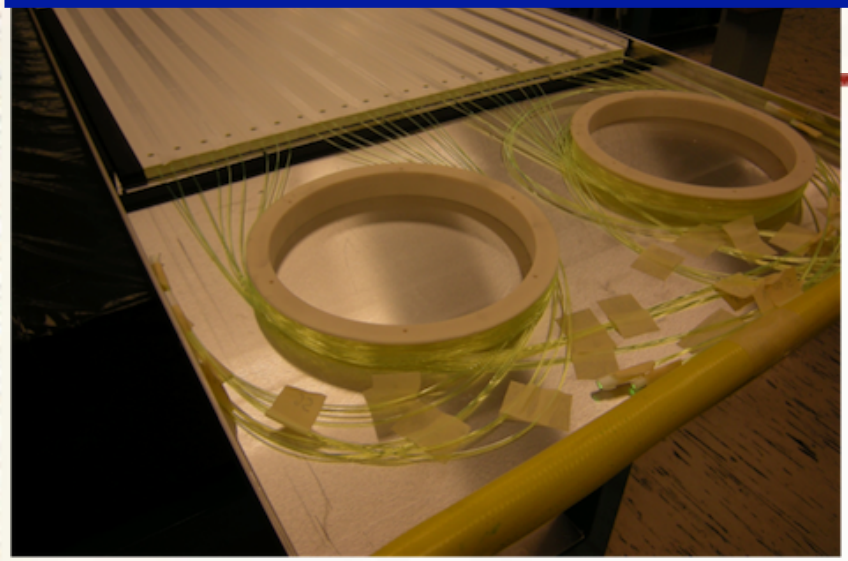
Active layers housed in light tightened boxes (aka Pizza Box)



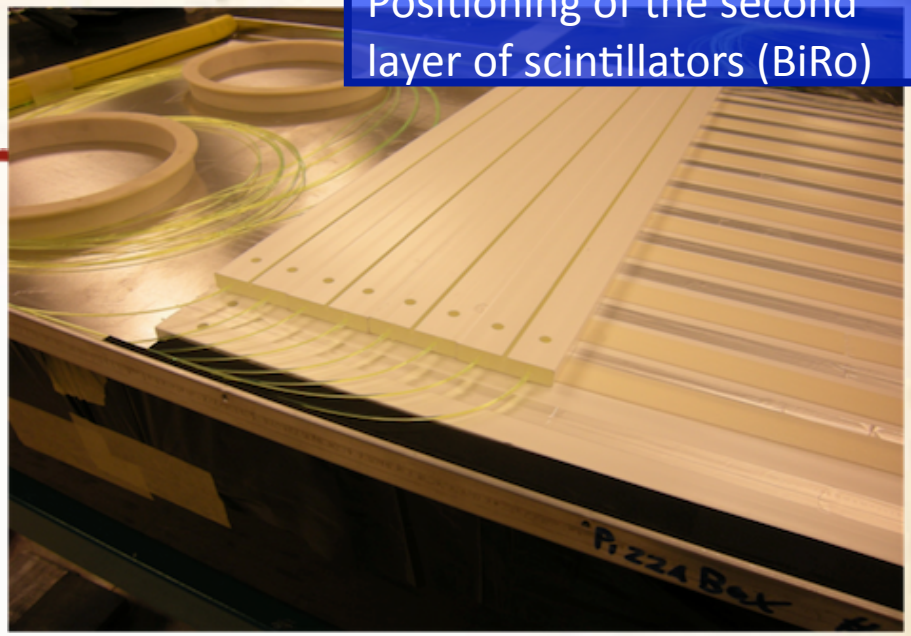
4 special modules to study different fibers or SiPM
Three types of SiPM with different geometry to be tested:

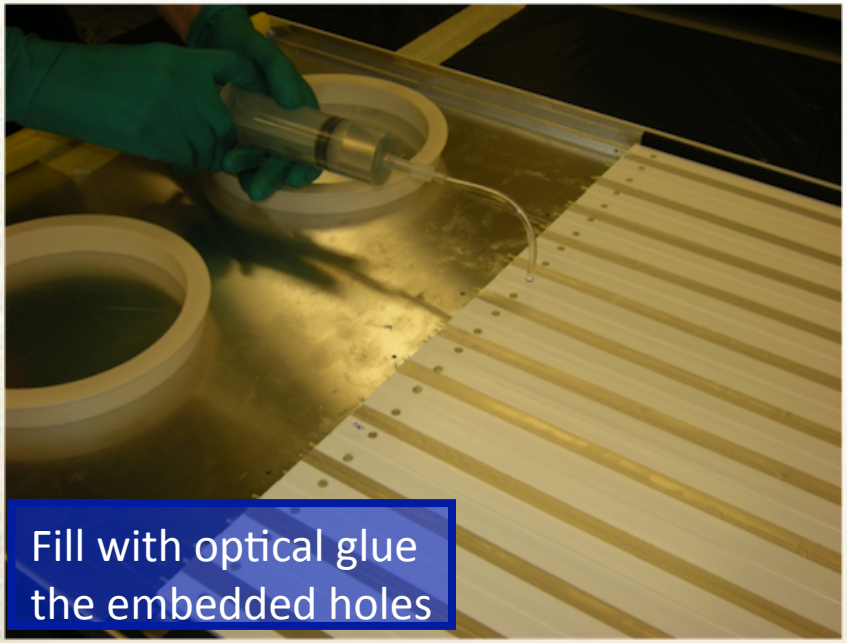
- 1.2x3.2 mm^2 to be coupled to 1.0mm fiber
- 1.4x3.8 mm^2 for 1.2mm fibers
- array of 3 round sensors: f=1.4mm for both 1.2 mm fibers

collecting the fibers around the supports

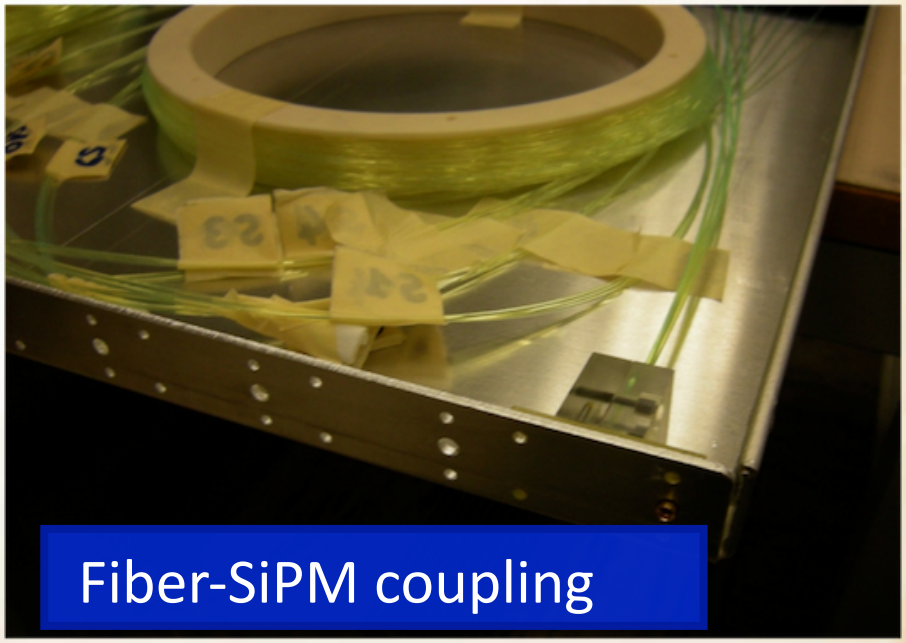


Positioning of the second layer of scintillators (BiRo)





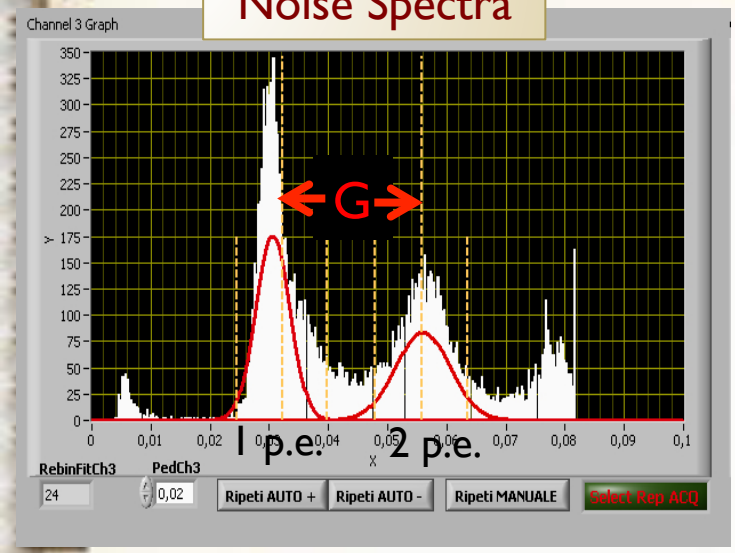
Fill with optical glue the embedded holes



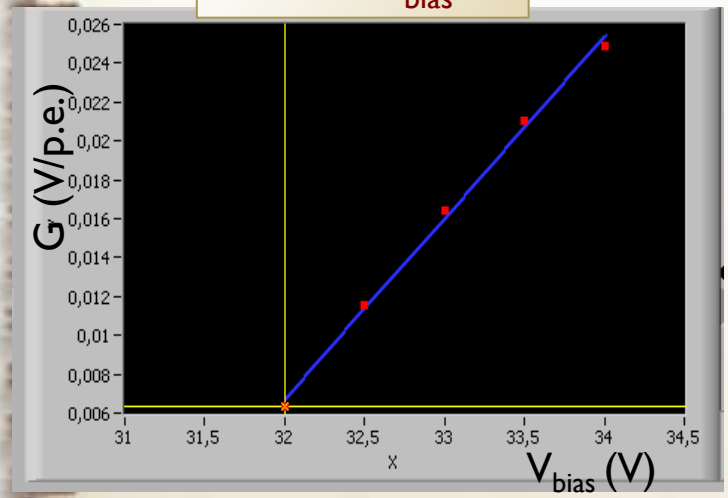
Fiber-SiPM coupling

SiPM characterization

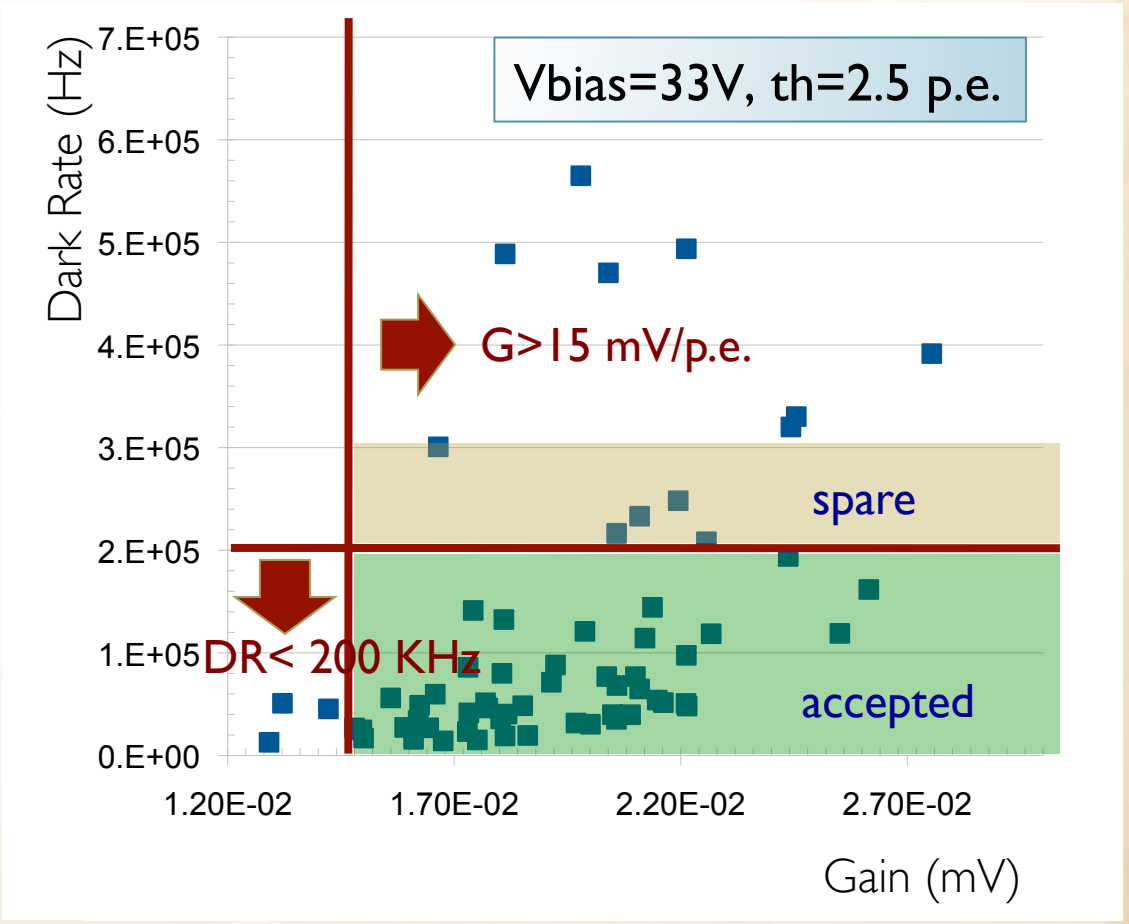
Noise Spectra



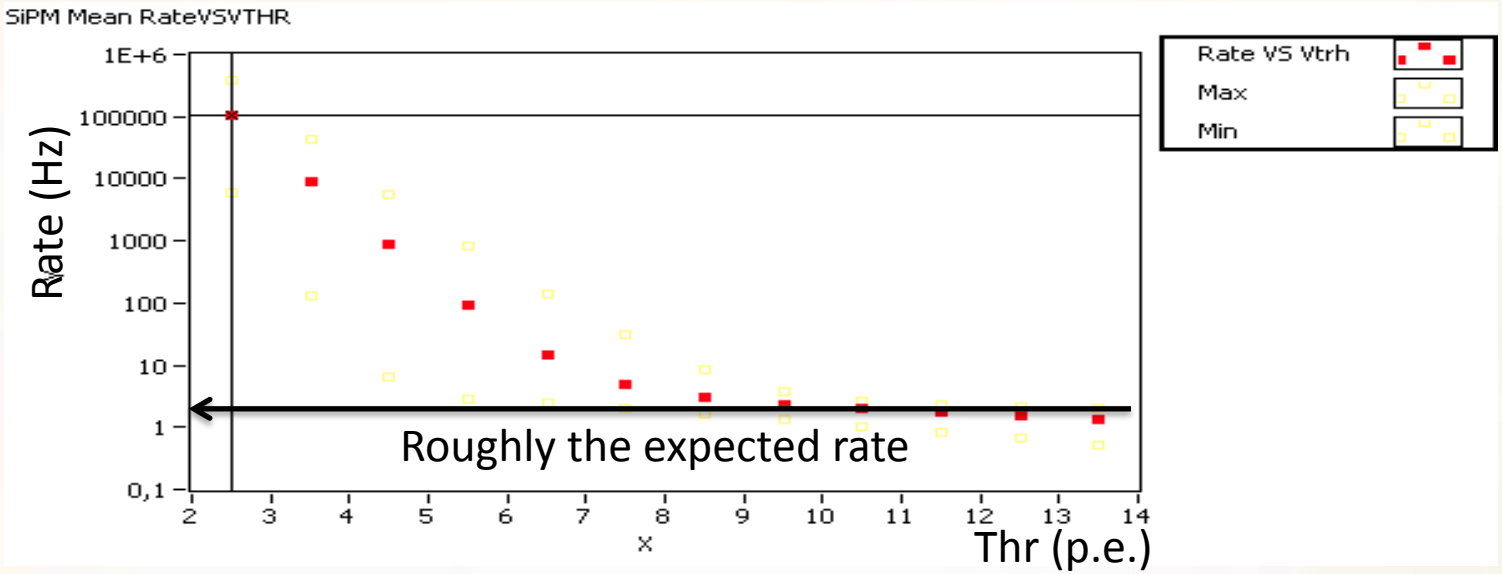
G vs V_{bias}

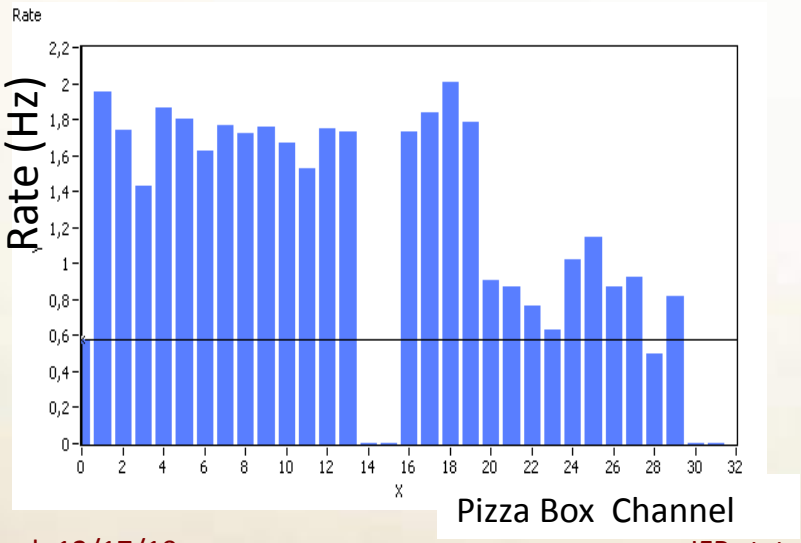


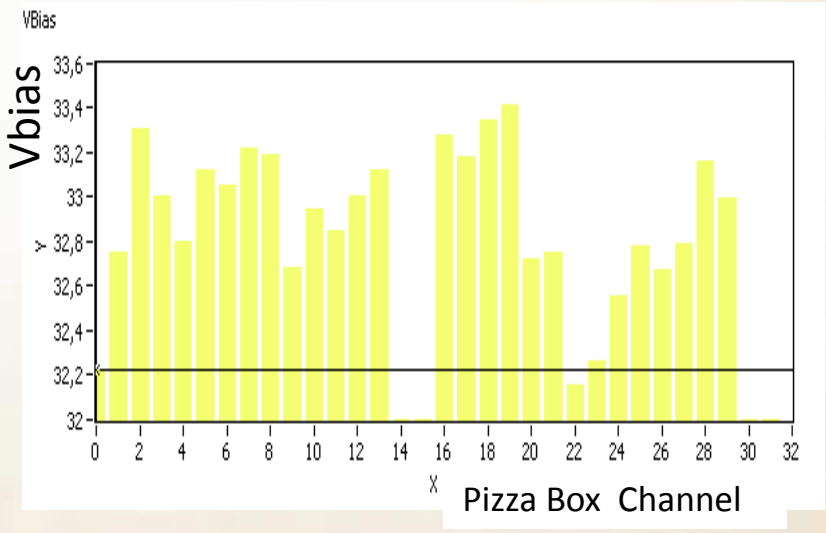
Gain and Dark Rate vs V_{bias} are measured to select the most homogeneous and best performing devices.



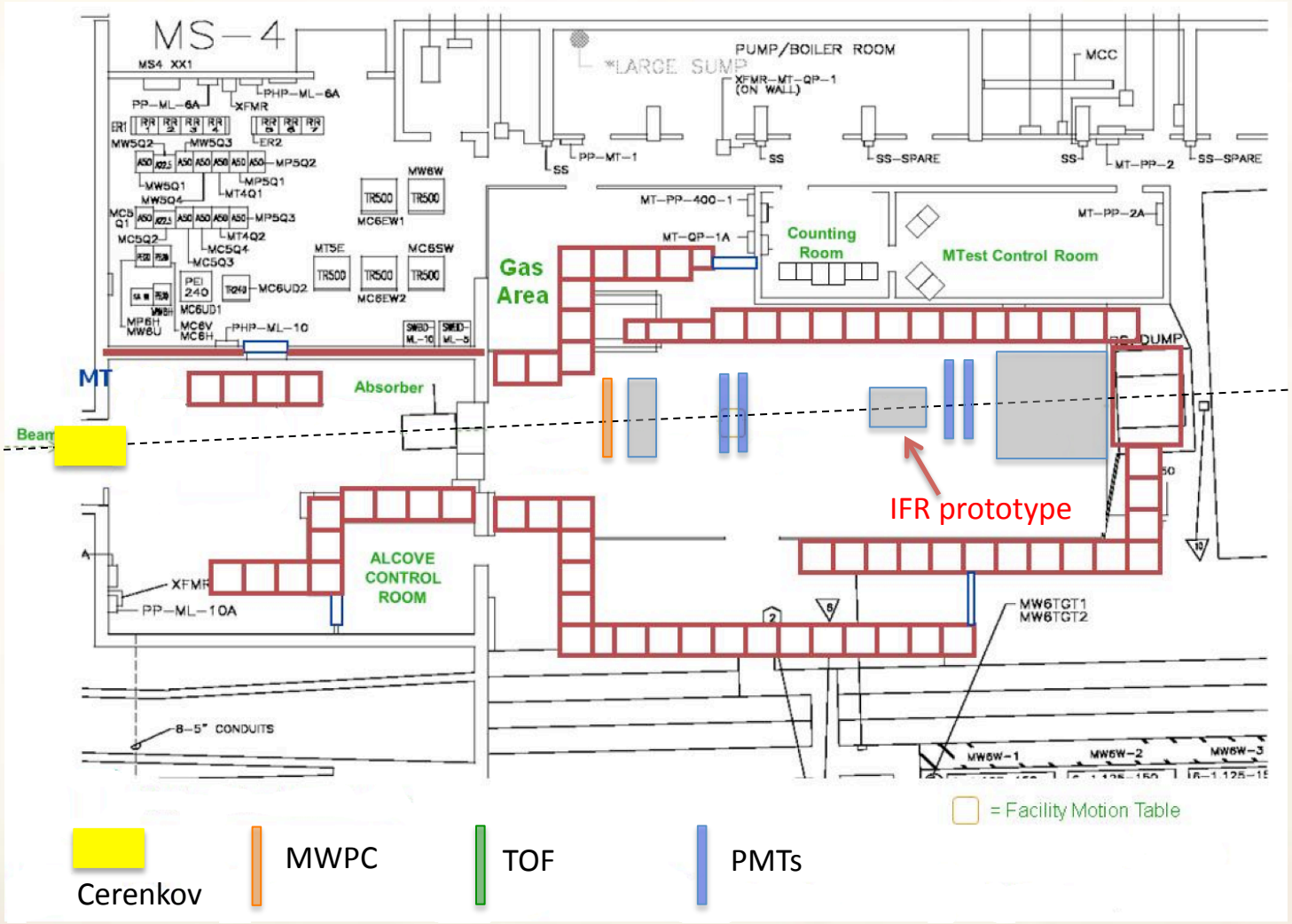
Cosmics test in Ferrara



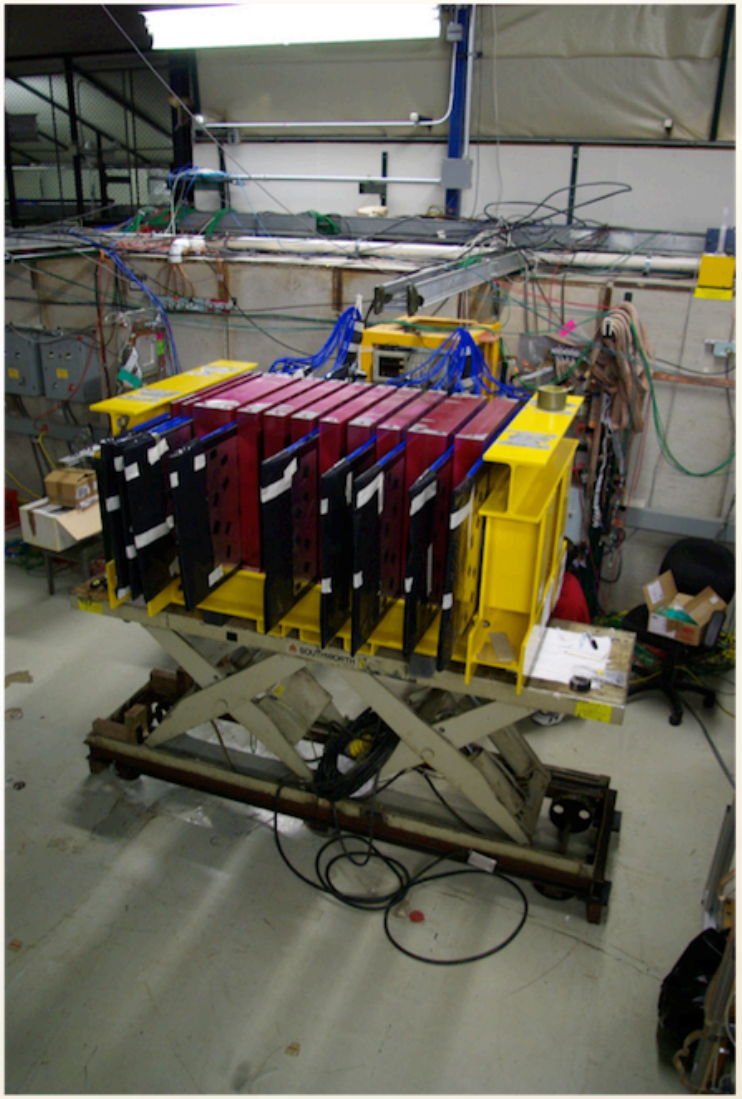




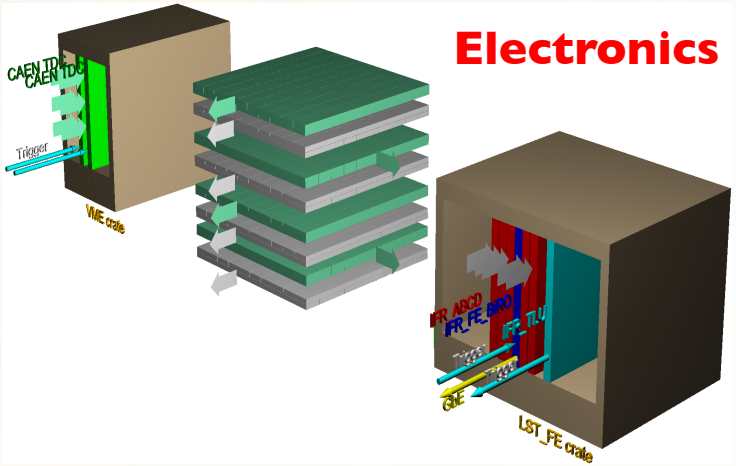
Beam Test at Fermilab



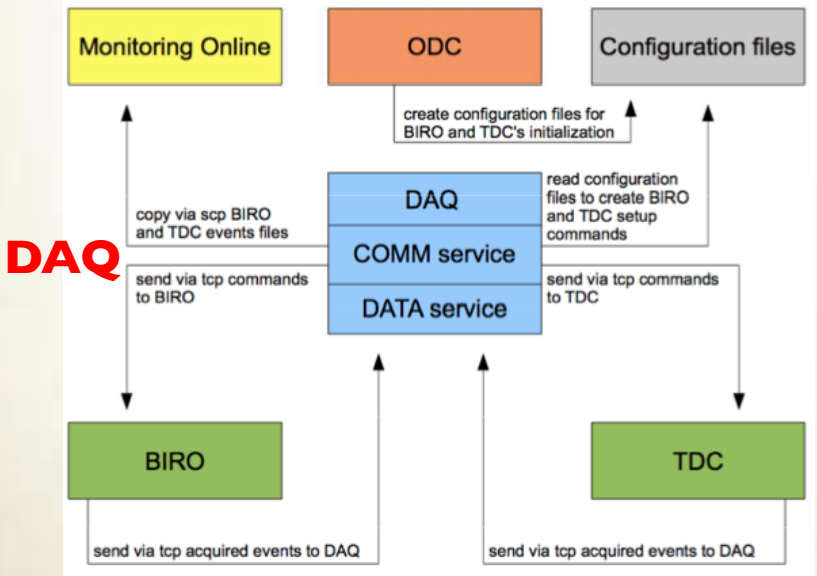
Prototype installation

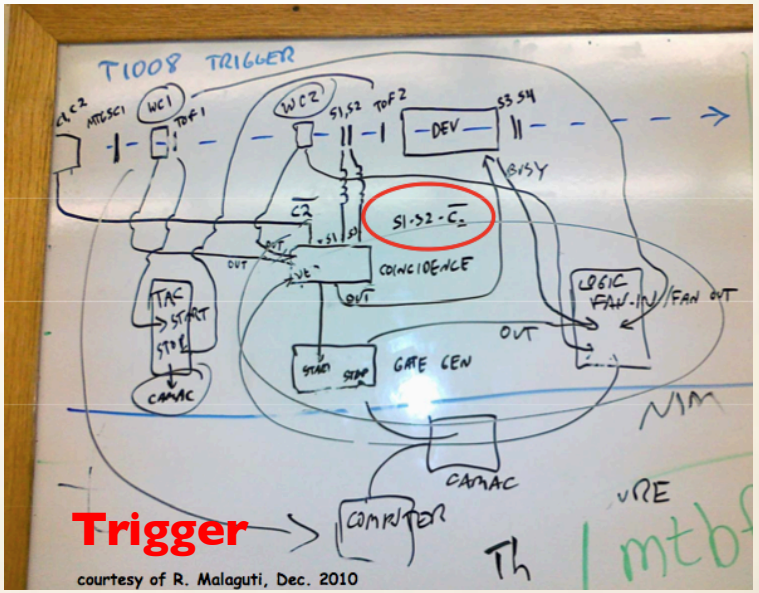


EDT



- ABCD boards provide Amplification, Bias, Comparator, DataProcessing one for each layer
- One BiRO-TLU board featuring BiRO DAQ and trigger/clock generator/distributor for Biro and TDC
- The TDC subsystem uses 2 CAEN TDC modules based on CERN's HP-TDC





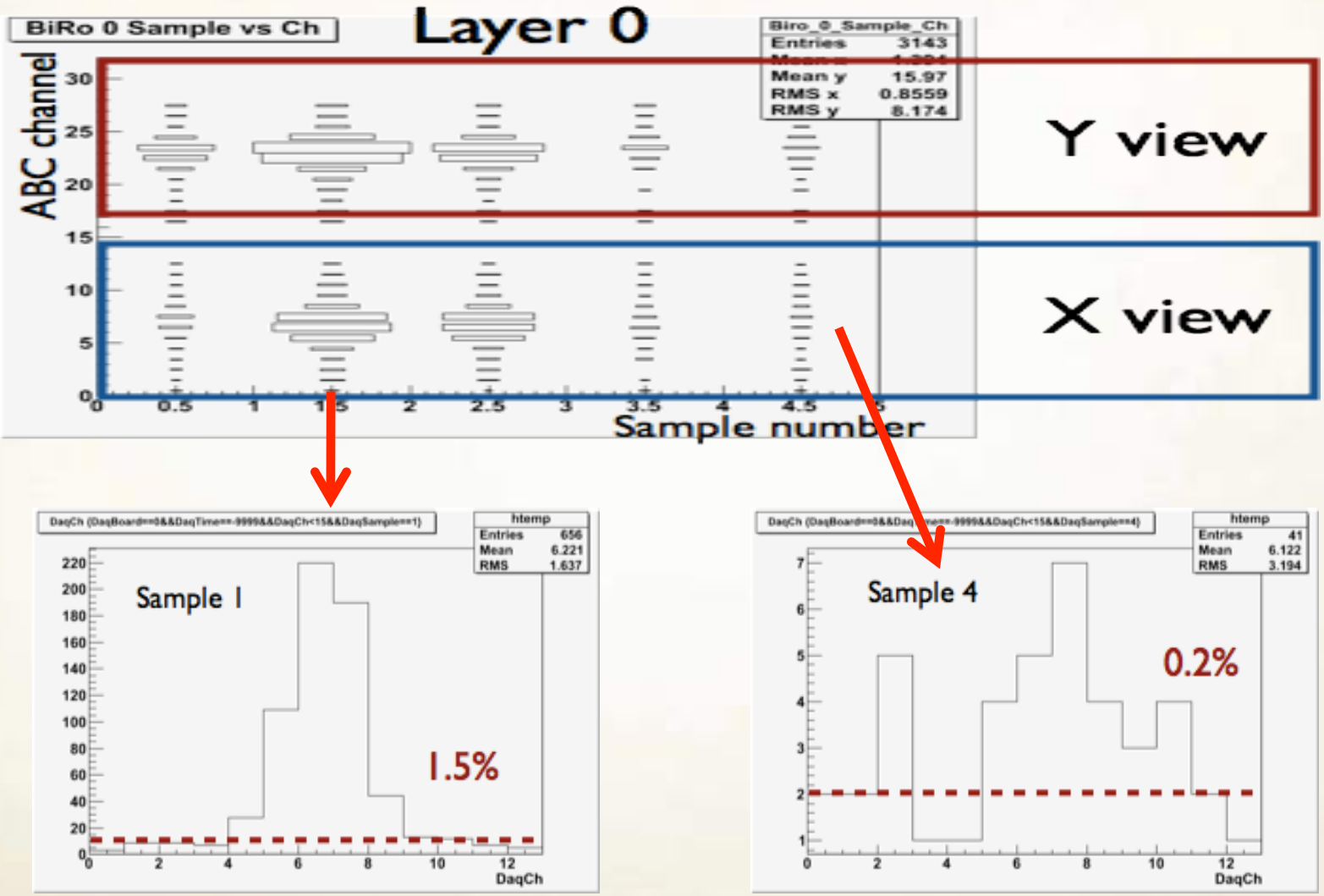
Beam test experience

- Our prototype worked well during all the data taking.
- We took data with both systems (BiRO and TDC) with no downtime due to our detector.
- We had only a couple of dead channels in the electronics, that died during the installation when we didn't ramp up and down properly the bias voltage.
- Some minor issue with some TDC channels.
- No big noise (actually we had less noise than in Ferrara).
- The only problem was the Cerenkov counter of the facility that didn't work fine with the C4F8O gas, that prevent us to explore the region at low momenta (<4GeV)
- But all in all a good running experience for our detector.

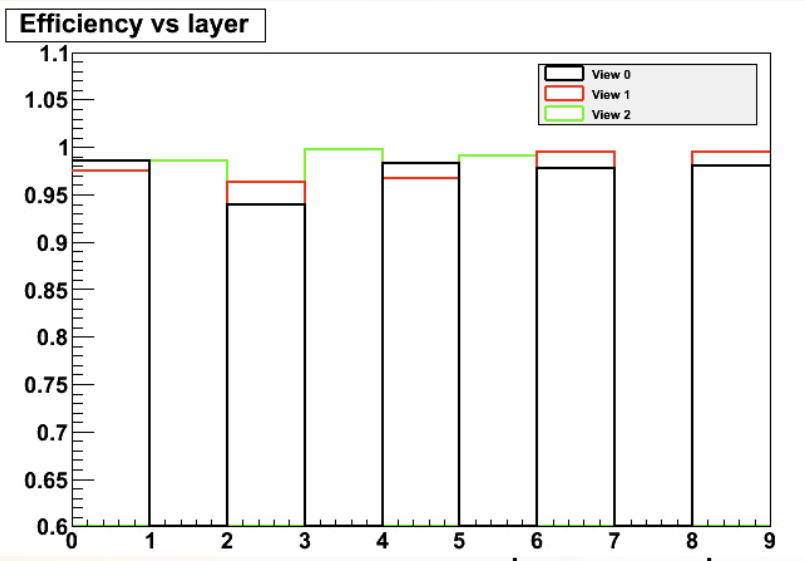
Measurement done

Things to learn…	…they depend on (parameter to change)…	… and need (number of events)	
Detection performances (efficiency, dark count, occupancy)	SiPM settings (gain, thr)	Even 10 kevents per conf: very fast at high momentum	Completed including special modules
Tracking performances (time resolution, track reconstruction, multiple tracks detection)	Mainly SiPM settings	~50 kevents, we can change parameters only with high rate (i.e. high momentum)	Completed including special modules
Particle ID (muon pion separation)	Mainly beam momentum and absorber configuration but also on SiPM settings	~500 kevents distributed over the entire momentum range (1GeV – 5GeV)	Done only at high momenta (≥ 4 GeV)

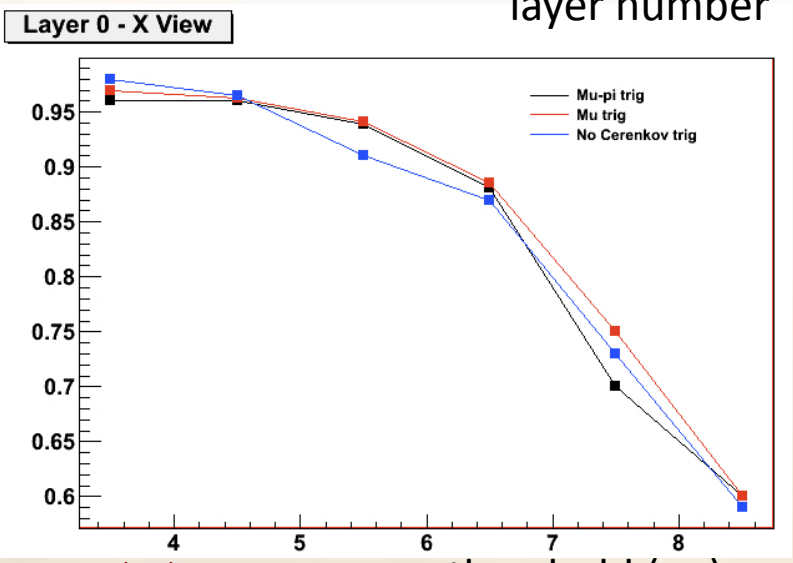
Hit maps and occupancy

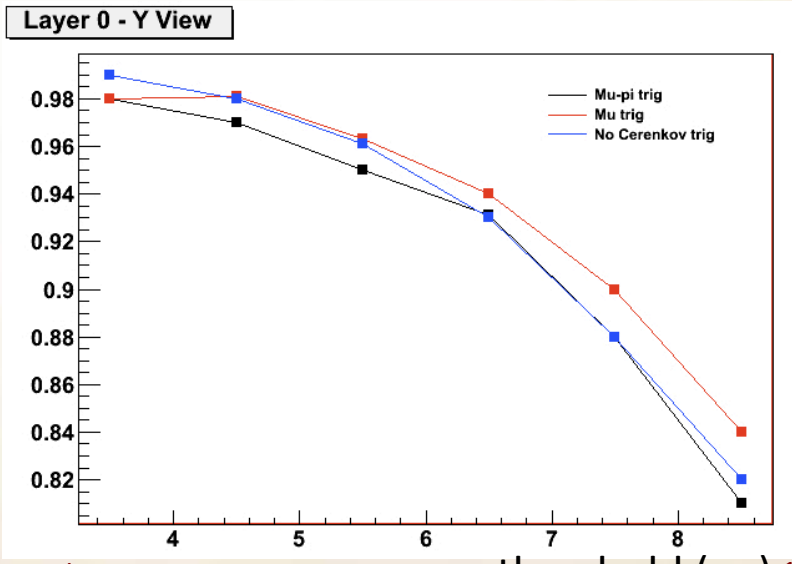


Efficiency measurements

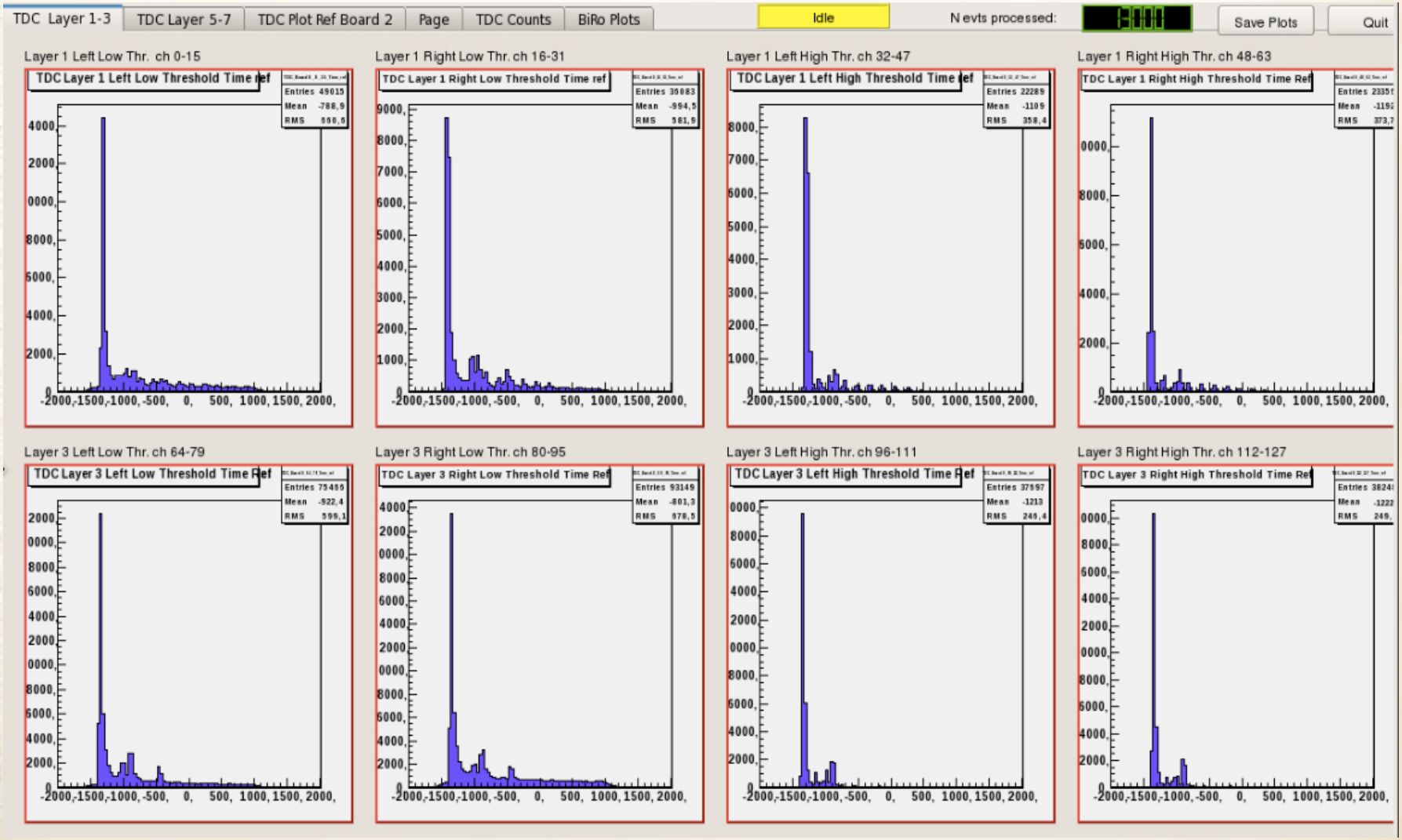


We selected events that passed through the prototype to calculate a sort of sandwich efficiency.

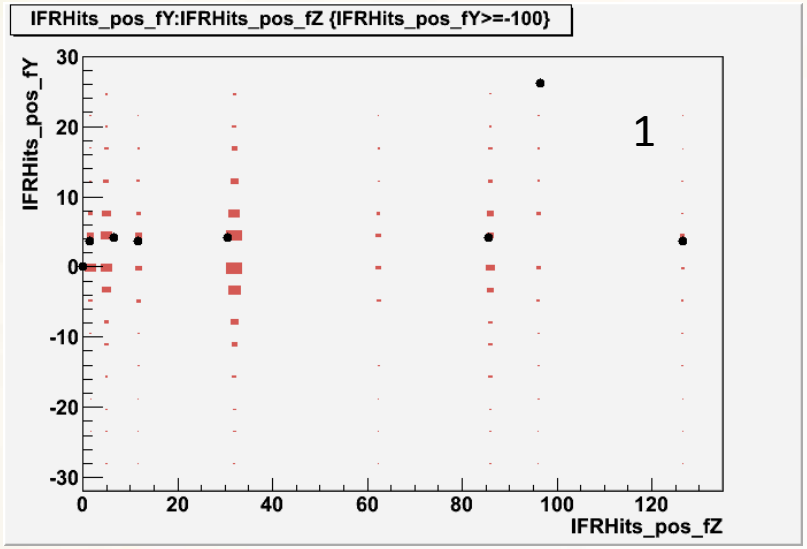




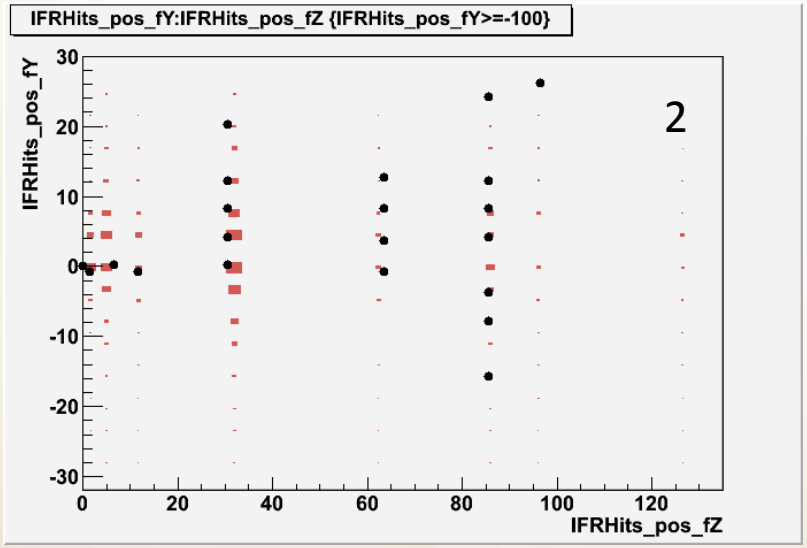
A first look at the time distributions

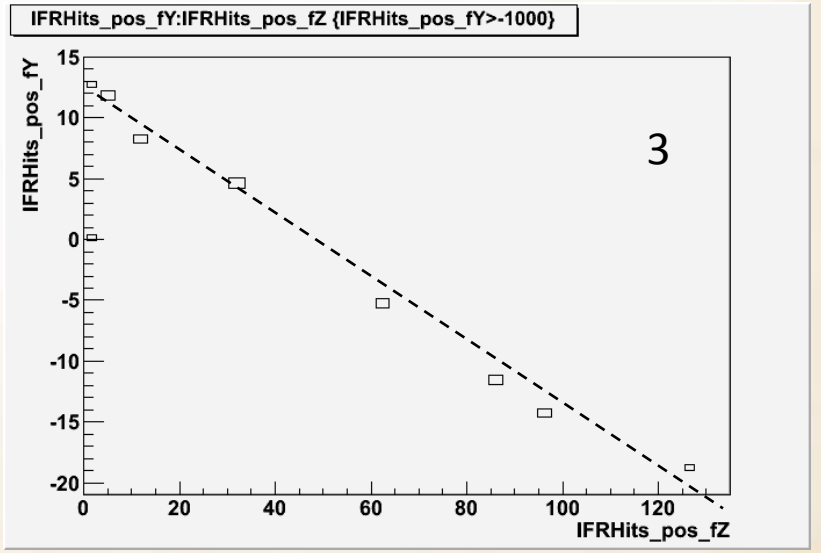


And we tracked particles



1. Muon
2. Pion
3. Cosmic ray





Critical decision to make

- Decision to add 10 cm iron (external) to the flux return

spring/summer 2011

- Electronics readout
  - TDC readout: meet the required specs

spring/summer 2011

- 8 layers vs 9 layers
  - Comparison of performances/costs

spring/summer 2011

- Understand SiPM damage and remediation
  - Reduction of neutron flux
  - Location of SiPM

summer 2011

What is still missing for the TDR

- Beam test data analysis (spring 2011)
- New beam test (July or September 2011)
- Simulation tuning with beam test data and updated results (summer 2011)
- More cosmic runs (spring 2011)
- TDC prototype development (fall 2011?)
- Construction and test of some full length (4metes) modules (spring/summer 2011)

Outlook

- With the beam test the IFR made a new step toward the TDR.
- Critical decisions will be taken once the data from test will be fully analyzed
- An additional beam test will be needed to explore the region at low momenta.